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Seminar

Identifying and securing India's critical mineral needs for net-zero transition

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Introduction

Rajesh Chadha:

... attend this seminar. My special thanks to the panellists who are sitting on the dais. Thanks very much, Dr Mohan for being with us for the opening remarks. Just one request, we are quite time bound and the one request, put your phones on silent mode. So that we can proceed shortly. Over to you Dr Mohan.

Rakesh Mohan:

Thank you very much, Rajesh, for organising this. This work has been going on at CSEP for almost three years. It was started before the Glasgow and then of course we were delighted when the prime minister made his commitments in Glasgow to set the net-zero mission's target for 2070. So, that gives a very, very clear green light to the whole energy sector along with other sectors affect emissions and a lot of that work is going to do with the power sector of course, energy sector, those of vehicles, all the electric vehicles and so many other things. In our work led by Dr Rajesh Chadha, __started work earlier on mining sectors as a whole. The mining sector strangely is not very well researched. And also, I would say even though the joint secretary mining is here, who I will welcome in a few minutes, is also not been among the highest policy attention that it has got ever since the reform started, now 32 years ago. So, that is why we started the mining work, and as we were doing the mining work, we then obviously came across the critical minerals issue. And then along with the other work going on at CSEP on the energy sector, it became clearer to us that so much of the energy transition, climate change work will eventually depend on critical minerals. The 'critical' is indeed the right word, they are really critical. Because as we expand the renewable energy supply since of course it is time of day dependent, also seasonal, there will have to be a lot of storage. If you are going to get good 24X7 power. Because the only other alternative if we don't get enough storage is they will have to use a lot of fossil fuel energy. To the extent that the share renewable energy in the world is still very low already the problem is beginning in terms of supply of critical minerals. So, that is why we started our work. Then of course, we were encouraged as I said by the prime minister's announcement of the zero emissions target of 2070. So, that is sort of the background for this. We first had an edition on critical minerals 2021 and this is the second edition recently in April 2023. We were delighted since we were doing this work very quietly without telling anyone really that the ministry of mines noticed this work and started consulting Dr Chadha and his team. And so, we were obviously really happy that the ministry of mines came out, appointed a group, consulted many academics, researchers etc and have indeed come out with a relatively comprehensive critical minerals list. Now, the question is having come out with the list, what we do going forward in terms of securing our share in some sense what we will need in critical minerals for all the storage, electric vehicles and so on. This is going to be very important and among some other work that we also doing at CSEP is that it will also have foreign policy implications. Which is why we have Ranjan Mathai here who has indeed of course, worked as a very distinguished ambassador in different places in the foreign service. So, the point I am making is that even though people might think what is the critical mineral, what is the small thing you are talking about? Actually, it is going to be the new oil. And just as oil, has really impacted all kinds of strategic activities to do with the middle east and other oil producing nations, this is going to be extremely important from overall strategic point of view and every country's foreign policy and particularly any large countries foreign policy. So, this is what I

understand from all this. I am absolutely delighted that Suman Bery, the vice chairman NITI Aayog has indeed also found it important enough to come today to attend this. But he actually has a background also in the sense that he was among the first people who encouraged us on our mining work. And was a member of the advisory council for the non-fuel minerals and mining. Clearly took over as the vice chairman NITI Aayog. So, we owe him a special word of thanks. However, as I said, until he became vice chairman of NITI Aayog, but I don't see why that should stop him from continuing to be a member of our distinguished advisory council. And since he is only vice chairman, he can become chairman of the advisory council. That will be a promotion for him if they make him chairman of the advisory council. Let me just very briefly… Mr Bery actually I have been associated with him to his regret for 58 years. We will have a 60th anniversary a couple of years from now. I have watched his whole career from the time he was 16 years old or 15 and ½ years old. He of course worked for the World Bank. He joined the World Bank when he was a baby. And then he spent 28 years there to become an adult. He then succeeded me actually as the director general of national council of economic research. After that he became chief economist for Royal Dutch Shell. Which also then indicated his interest in energy. He has been a member of the Prime Minister's economic advisory council, India statistical commission and also the reserve bank of India's technical advisory, accounts committee monetary policy, which is a precursor to the MPC in the reserve bank. Ranjan Mathai is of course I have just said, distinguished ambassador for foreign service. He has served in Vienna, Columbo, Washington, Tehran and Brussels. And has been ambassador to France, Israel and Qatar. Before serving of course as the foreign secretary 2011 to 13. He has also worked just before he retired or just before he left as high commissioner in the UK 2013 to 15. But he has been very interested in the importance of mining to India's national security and also on critical minerals in particular. We are very happy Veena that you are here with us. Veena Kumari Dermal who is joint secretary ministry of mines. She belongs to the 1998 batch of the Indian postal service. I am very glad that the government of India now thinks that people other than IAS who can do good work. So, I am very happy that you are joint secretary of ministry of mines and have led this work on critical minerals. She joined the ministry of mines in 2017. So, you have actually been there for six years in the ministry which is unusual for anyone in the government. She was pivotal in making amendments to the MMDR in the 2020 – 21 and Rajesh I think that later on we should also have some discussions with her on MMDR and act and what more needs to be done. So, she has obviously a great understanding mineral policy in India having been in the ministry for six years. She is a government's director on the NALCO, Bharat gold mines. Do you being a director of lot of gold mines, do you get some gold? Board meeting fees, sitting fees? (Laughter) And also Hindustan zinc and KABIL. Pankaj Satija is the managing director of Tata steel mining. He is a graduate engineer from IIT which is the Indian school of mines in Dhanbad and with the PGDM from Excel Orion, Excel Orion junction program. And he is a certified coach from Ericsson coaching international. But what do you coach? Golf?

Pankaj Shatija:

Executive coaching.

Rakesh Mohan:

Executive coaching. I thought basketball or wrestling or something. (laughter). He is a certified coach. He has been on the task force for SDF for the mining industry for the ministry of mines. And under his leadership the Sukinda mine of tata steel became the first in the country where a pilot launch of

SDM was done in 2016. He received the national geoscience award in 2022, the FIMI gem granite sustainability award 2014-15 and the Bala Gulshan Tandon excellence award from FIMI for 2016-17. So, welcome to everyone. As usual I have gone a bit longer than I should have. Now my job is over. So, I will take my sign board here and Rajesh will take over and moderate the discussion.

Rajesh Chadha:

Thank you very much, Dr Mohan for the opening remarks. Where you have also introduced the panelists. I have a special privilege of welcoming Mr. Suman Bery who has been my director at National council of applied economics research for 10 years. And prior to that Dr Mohan was the director general. So, it is my proud privilege actually, it is my humble privilege as well as proud privilege that I am speaking in between my two director generals. Incidentally we met Dr Mohan again 20 years later when he came from Yale to CSEP. So, it has been privilege working with both of you. Thank you very much, Mr. Bery for being on the advisory council and actually I think starting the mining research program here, I should be up front and thank you very much for that. Given that we are time constrained we will now have the keynote. I invite Mr. Bery to deliver the keynote. Thank you.

Suman Bery:

Thank you Rajesh and I don't want everybody feel that this is a close shop. With everybody thanking each other. But let me say that in my new role I do have to worry about being somewhat even handed and the fact that my appearances at NCAR and CSEP way exceed my invitations… let me put it that way… elsewhere, I think reflects not just sentiment and nostalgia but actually the fact of the quality of the work and I do have to say that this started off as being a non-fuel mineral. And what do you know. Suddenly these minerals start to be as important for energy as coal, particularly coal and also oil and gas which is not to say that CSEP has not had a very important work program on coals, I think. We have Laveesh Bhandari the new president who has looked at the fiscal dimensions of the energy transition. So, I would say that to a degree that's exemplary CSEP has been working systematically at various levels on so many different aspects of what is the huge challenge facing India. And what is that huge challenge? That huge challenge is to become a developed economy while not relying on fossil sources to the extent that all our predecessors did. And it is a testament I would say to the leadership of the honorable prime minister that he, I think that ambassador Mathai perhaps would not disagree, to some extent took on the received wisdom of the bureaucracy in signing up at COP21 to being a part of the whole clean movement. Because that had not been the attitude prior to that had been, this is a problem created by others and we have to grow. So, we are where we are. I came here yes, to signal the quality of the work but also the importance of this whole area. As has been indicated by both Dr Mohan and Dr Chadha, my engagement was actually on the issue of mining and I am pleased that on the panel I may not be able to stay to the end. We have representatives from the ministry of mines because we had Dr Rajeshwar Rao at NITI Aayog, I think he was an AS in the mines ministry. So, all I am saying is that there has been a lot of movement and activity in the regulatory framework for mines and this is a slow business. But what one tended to hear in the advisory group was that so far, the results had been underwhelming. And I think before we get on to critical minerals, we have to ask two questions. So, does the criticality of the minerals make it or do we know how to get around the constraints and bottlenecks that have held up all mining just because the minerals have become more critical now. And I think that is an issue that we have to face. When I go to some of the states which are mineral rich and I am not saying this is

necessarily also including the non-ferrous minerals, but there are a lot of complaints about the deal that the states get environmentally and in terms of restitution from PSUs and a lot of this tends to be in the PSUs. So, the first point I wanted to make is okay, you know, we can see this, this oncoming train. But if we are not able to fix on the one hand the issues connected with minerals in the way that we are not able to fix the issues connected with transmission, then a lot of stuff kind of become secondary. And so, part of what we need to understand is how does making a mineral critical get around all the constraints that have bedeviled the sector up till now. Now, on the issue of critical minerals there is very fine not only analytic work, but what I might call almost taxonomic work, I mean the two papers produced by the team by Ganesh and Rajesh, just gives you a clear structure within which to think about these things. So, there is on one hand the extraction and processing. And it turns out that the lead of China is really much more in processing than it is in extraction. Then coming to the domestic scene, I don't want to steal Rajesh's thunder, this is all probably in his presentation. But it is part of the educative role I think of the work that he and Ganesh has done and this is hard one. Hard one knowledge. I don't think they knew all this three years ago and it is by continuing down this path that they are able to present the issues with the clarity and I think Rakesh, he claimed that he read everything that was published by CSEP. So, let me give or allow you take a bow as well on the very clear presentation. The question being how much of the focus should be on extraction? How much on processing? And I think the reference to Atma Nirbharta basically indicates that you get an increase in energy security if the mineral is domestically extracted and processed. I think that is an assumption that we should test critically. Because my own view is that as it were, diversification of all kinds is probably a better way of ensuring security. So, the first point was, is there a minerals issue that we need to solve before we can think about critical minerals. The second issue is that, yes, by all means we should pull out all the stops but does that mean… or what does that mean in terms of our cross border engagement in this whole area. On the cross border dimension, I think there is a lot going on. I know that not all critical minerals are connected with electric vehicles. But quite a large part of them are. Within electrical vehicles it is largely batteries and battery technology. It is so, two points. One I don't know and maybe we will learn in the presentation that our EV strategy is fundamentally different from what is going on in China, the EU and the US. In that as I understand it is around public transport and it is around two and three wheelers. Four wheelers are there. But they are not the dominant part of our EV kind of supply chain. Whether that makes a difference or not I don't know. But I think it is important to know that the path we are going down is a different path from the big boys. But the much more important point I think was brought out… I was in the US on the program at a conference at the Peterson institute. One of the speakers there was somebody called Jennifer Harris who had been in their national security council and she indicated, as you probably know there was this inflation reduction act which has made huge subsidies available particularly for electric vehicles and other dimensions. She made it clear that basically the intention is to try and move whole supply chains out of China to trusted partners. And the question of what kind of compact global architecture we need so that we don't end up where we have ended up with LNG, where at the moment of crisis in Europe, all the LNG cargos have been bid away from India. The same thing could happen with Lithium, it could happen with all these other things and I would recommend to those of you who have access to the financial times, this article by Jennifer Harris which basically says that we have got to start treating these critical minerals as essential commodities where there is a need for global management. And I would just point out to you that in the India – US joint statement and ambassador Mathai would be able to illuminate this better than I can. But in Para 19, they say that the India and United States committed to create innovative investment platforms that

will effectively lower the cost of capital and attract international private finance at scale to accelerate the deployment of greenfield renewable energy battery storage and emerging green technology projects in India. And it goes on to talk about Prime Minister Modi and President Biden affirmed the intention of the two governments as trusted partners to work together to ensure that our respective markets are well supplied with the essential critical minerals needed to achieve our climate economic and strategic technology cooperation goals. So, I think I have used up more than my time. So, I am making the point that solving the mining problem is essential which is a federal problem, that if there are accelerators for critical minerals, I don't know if they are adequately identified and the mines ministry can indicate to that. But for Atma Nirbharta to imply that we can be self sufficient at a time for a scramble is probably wrong and so exactly as was mentioned, the diplomatic dimensions and the cross border dimensions and the FDI dimensions and the investment treaty dimensions become as important as the overall architecture as just the supply side. I leave it at that and I look forward to your and Ganesh's presentation.

Rajesh Chadha:

Thank you very much Mr. Bery for your encouraging words and guiding words towards what we should be looking forward to working for the future. We have a brief ten minute because we have panelists who would be guiding us on various aspects. We have a brief 10 minute presentation that Ganesh and Karthik will be making and before that may I invite you Dr Mohan and Dr Bhandari for a release picture that we never had earlier. So, please come Ganesh. I think I saw Mr. Mehta. Please join us. (Photography) Thank you very much. Now I invite Ganesh and Karthik who have been my co-authors on the new volume that has been published to make a 10 minute presentation. Not more than that because we have to hear from the panelists then.

Karthik Bhansal:

Hello everyone. Ganesh and I will now be taking you through a brief summary of the paper. I will be showing some key highlights of the paper. The paper on critical assessment from us has a background and we would like to share the context of it. We all know how essential critical minerals are as we have heard from various speakers here. It is a key factor of production for various minerals for various products and the most important product that critical minerals are essential for is green technology. It is vital for India's COP20 commitments for net-zero emissions and therefore they become very, very important for India's economy as well. Strategic minerals is a term that you would see used in various government reports. The reason being that they are also strategically important as they are essential for the manufacturing of military and defense equipment. The objective of the study overall is to go ahead and help in securing supply chains by making and by assessing and building mineral-wise strategies for India. Our second edition takes from our first edition which was on 23 minerals. We expanded the scope of our study to include more minerals and make it 43 mineral study. We also expanded our methodology and added few more indicators. The critical mineral assessments work was earlier done by the planning commission and the Indian mines and also the Indian mineral inventory. But there, there was only a mention of strategic minerals and not a proper assessment study. The first ever criticality assessment in India was taken up by the department of science and technology and CEEW first in the year 2014 and 2016. The national mineral policy further emphasized on the exploration and used the term critical minerals within the policy. At CSEP we furthered the objective of this criticality framework and came up with our first assessment study in 2021. And then in 2023 which is our latest report being discussed today. Critical assessment is done by major

economies all over the world. Australia, EU, the United States, all do critical assessments for minerals based on their economic needs. Here these studies are done periodically every three years. And India would also then have to do periodic assessments so on and so forth. For these assessments both demand and supply side are two factors that are assessed before we get to the criticality framework. We in our paper use the EU methodology. While we use the EU methodology we do differ from the methodology in some ways, add a few indicators which we will further discuss. As Mr. Bery also pointed out to us, that the geographic concentration becomes a very important factor. Through this we think that India would be able to… the assessment of criticality becomes important in framing polices to combat such geographical concentration. As can be seen on this slide, for instance, for cobalt, the republic of Congo ends up extracting over 70% of the mineral. While on the processing side it is largely done by China. Similarly for lithium while the extraction is largely by Australia, over about 50% of the same mineral is processed purely in China. Therefore, it is important that the criticality assessment is done because criticality assessment allows us to make focused policies on minerals and focus policies towards what minerals need to be assessed and what minerals require strategic concentration. For choosing our minerals, every jurisdiction chooses minerals based on their own economic need, their own economic importance and how these minerals are applied within their economy. You can see examples of various jurisdictions on the screen and what were the number of minerals they found critical post their latest assessments. Some of these assessments have few minerals in common. You will see these minerals are also common in our study. These minerals are minerals like cobalt, lithium, niobium. These minerals are important because of their end use. The specific end uses these minerals go into is green technology, renewable energy, defense and also batteries which is the talk of the town right now. For our specific study, we use 43 minerals and they have been assessed. Ganesh will further be also talking about the results of this study. The mineral studied are displayed on the screen here. And these are 43 minerals and in total 23 addition more minerals to it. And they are highlighted in green. We have also studied rare earth elements in two groups. That is light rare elements and heavy rare elements. But would like to point out two minerals in specific that we study separately even though they are rare earth elements. And that is neodymium and scandium. Even though they are rare earth elements, they are cross cutting applications across various sectors and therefore we study it individually within our study. Our CMA methodology includes looking into the economic importance and the supply factors and the supply side factors. They have various indicators within it as shown on the screen. These while are adopted from the EU methodology, there are specific frameworks they have included specifically in the 2023 study. I would invite Ganesh to further explain what these specific indicators are and where did our study go. Thank you.

Ganesh Sivamani:

Thanks so much, Karthik. Thank you so much for the panelists for being here. As Karthik mentioned we have been using the EU methodology which separates the criticality along two different dimensions. We have the economic importance and also the demand side factors and we have the supply side factors. Under each we have a few indicators. So, on economic importance we have these four indicators. The disruption potential, this is a measure of what share of the manufacturing gross value add would be affected if the mineral becomes non available. And this is based on each economy's needs. So, in the case of India, we saw that lithium, iron ore and limestone have high potential for disruption. Substitutability is a measure of if other minerals which can take up the same processes that the mineral under study can. There are a couple of minerals which we found to have

no substitutes for their end use application including neodymium and rare earth elements. We also had a new indicator in our study compared to the EU methodology called the GVA multiplier coefficient. This is a measure of how indirect impacts of a mineral non-availability can affect the manufacturing sectors in India. And finally, four, the economic importance, we also have cross cutting index. This is a measure of how some minerals such as copper can be used for a wide variety of final end use applications. On the supply side we have a few more indicators. Starting with the concentration which has been discussed earlier. This can be both on the extraction and the processing. So, there is some minerals like gallium, germanium and niobium which have high concentration in extraction and you may have seen in the news recently how China has put curbs on their exports of gallium and germanium which are both essential for semiconductors and other electronics manufacturing. On the processing side, some minerals like niobium, phosphorus and scandium have high processing concentration. We also included the quality of governance of the countries that either extract or process minerals. And this is important to understand how the relationship with these countries can work and the ease of doing business in those countries. A famous example or infamous example rather is cobalt mine in Congo. And how the governance factors could affect mining operations in that region. We have also included the bottleneck analysis. This is something the EU does and we have included in our recent study. And here we look at how supply risk could be different based on the extraction and processing. And we take the stage in which the supply risks are higher. For example, in zinc the processing supply risk for India are higher whereas in cobalt the extraction supply risk is higher. Finally for the end of lifecycle recycling rate and import reliance, these basically can help dampen supply risk if either we are reducing our import alliance or increasing our recycling rates. We also looked at substitutability on the supply risk side and this looks at the substitutes, production levels and the ease of mining. Some minerals for example, coal mined or byproducts of other processes which makes them harder to extract and may increase the supply risks. Finally, the results of our 2023 study, we have looked at again the supply risks and the economic importance. Certain minerals may have high supply risk but not high economic importance and vice versa. Some minerals of course, are high on both. This is what we call critical minerals in our study of which we have found 22. Of course, the threshold values that we have chosen are based on our judgement and this can be changed depending on the context. Given the recent announcement by the ministry of mines, of their list of critical minerals, they have identified 30 minerals as critical for India. We just thought we can compare some of the minerals and show the overlap between the two lists. One thing to note is how the ministry of mines has decided to avoid using bulk minerals like iron ore, limestone and bauxite as critical given that they are bulk minerals and are already available in India. Finally, we thought we could have a couple of policy implications. To start with on the domestic side, we have talked about earlier how we can use the list of critical minerals to underpin a mineral-wise strategy on how to secure supply chains of these minerals for India. Secondly this is on the mining side or rather the exploration side. India has large mineral resources but more exploration and investments in exploration is required to harness this. As Mr. Bery also mentioned an accelerator for critical minerals would be apt. Finally on the domestic side more focus on recycling, formalizing the sector, getting up to the global practices would also be quite important. And we have written a bit about how E-waste could be a big source of critical minerals. And on the global side, the global climate cooperation, firstly trade agreements and the ministry of KABIL has already worked on MOUs with Australia and other countries. So, that is a good start. Also, the acquisition of foreign mineral assets. For minerals we don't have in India we may have to rely on other countries and perhaps setting up operation in those countries could help. Thirdly recently India

has joined the mineral security partnership led by the US. Which is a great start and we have also looked at how the G20 could also be involved and perhaps a mineral security partnership with G20 countries could be a way forward. And finally, but not least of course, is the ESG practices. This is something that is going to be very important. Especially for certain markets where ESG is held to very high standards. That is something that India should imbibe as well. Given the large number of people living over mineral wealth. I think I will leave it over there. Thank you so much.

Rajesh Chadha:

Thanks, Karthik and Ganesh for making this crisp ten minute presentation. Now I have the privilege of… in a way slightly making more specific, the knowledge that we have gained from Mr. Ranjan Mathai as on our advisory board and we are happy that he has joined us today. Because he has been writing about the importance of critical minerals in defense and energy security for some years now. In 2019 he highlighted the implications of national mineral policy, 2019. And set the tone for securing access to critical minerals for national security. During the pandemic Mr. Mathai re-emphasized the need for resilient supply chains of critical minerals. And more recently he has written about the US led mineral security partnership of which India was not a member last year, but has recently become a member. So, two things that came up after his last writing is that the ministry of mines has already declared 30 critical minerals and obviously India needs to integrate into the global supply chains. And given that India has joined the MSP, how should India take these issues forward during the G20 presidency and onward. I think Mr. Mathai will take around 15 minutes to make a presentation which he has prepared and so, over to you Mr. Mathai. Thanks for coming and joining us.

Ranjan Mathai.

Thank you Dr Chadha and it is a great honor to be with Dr Suman Bery, Dr Rakesh Mohan, Dr Chadha and his team and other distinguished panelists today. I must start by saying I feel like a rank amateur among professionals. I am not an economist. I have never worked on minerals. I approached this from a very obscure standpoint of looking at security while being a diplomat. So, I would like to take the advantage of looking at it not from the kind of professional expertise that you have already heard and you are going to hear from. I wanted to talk more about its implications for us as a country. And so, I ended up writing more than half hour and then Dr Chadha very sternly told me I had only half that time and that was a very big concession. So, I would like to just convey a kind of global and historical overview before turning the focus on India to say how did we get where we are today. Minerals as we were told are suddenly big news. Gallium and germanium, the Chinese have put these export controls. What is also come in the news is that the United States has invoked the defense production act to make sure it gets enough of these supplies and I was at the launch of the ministry of mines report. And I was really heartened to see the turnout of journalists. Normally they don't turn up when you talk about minerals and so on. So, that was very good. The third piece of news which again filtered through the pink pages you might say into the main stream was Indonesia being criticized by the EU and then followed up very quickly by the IMF and by the WTO for putting a ban on the exports of nickel and bauxite because they wanted to do more value addition at home. So, what is happening? In my view our high-tech digital world in which we live is discovering that it has mineral roots. And I believe the path to net-zero emissions is underlining the criticality and the depth of those roots. Now, since the industrial revolution two three centuries ago, major economic powers have recognized the vital role of key minerals. And have adjusted foreign and economic policies to get them. We have had wars and imperial adventures caused by minerals. After the second world war the

abundance of mineral supplies in the US and Soviet Union, Russia, as well as the liberalization of the global trade gave the whole world a degree of security of supply of minerals for industry. The problem was always oil. Not minerals. Major industrial powers depended on their industries investing domestically and specifically more abroad in some of the developing countries to develop these mineral resources. And they relied on trading giants. Many of whom are still very… not very well known names hidden away in the Swiss alps… who maintained this free flow of minerals all across the world. But the World War II experience had made both the super powers maintain stockpiles of critical minerals for defense and other strategic industries particularly any mineral on which they depended for imports. And I began to read about the pentagon's stockpile. This US stockpile is maintained by the defense logistic agency of the pentagon. Critical mineral stockpile. In later years other countries like Japan and Korea and China made specific plans for mineral availability. Some depended on their private sector. China in 1986 had a what is called the 863 blueprint of its scientific establishment which identified strategic metals or materials and rare earths. This program was updated in1997 and it is now called the 973 blueprint. And it is alleged that Deng Xiaoping said as early as 1992 as there is oil in the Middle East, there are rare earths in China. Whether he said it or not I don't know. But it certainly is a very relevant thing. And China is believed to have started work on a critical mineral strategy in 2003. But all these developments didn't make news headlines around the world. What changed? Climate changed. And the sense of importance of critical minerals has entered the domain you might say of general knowledge and general consciousness because of their role in the transition to a world of net-zero emissions. Just like oil was the subject of household interest earlier. You could wake up people at night and say what is worrying you? And they would say oil prices. After the 2015 Paris accords, minerals became part of the economic discourse. Think tanks began writing and speaking on the subject, so did I as you were told. Around 2016 – 17 the goal posts were shifted. And now suddenly it is no longer the Paris consensus we are talking about. Its net-zero emissions. And these are two different things. And minerals shot up even further on the global radar. In 2019 the World Bank came out with the first major report on the minerals in the energy transition which I think brought a lot of global recognition to this subject. This was followed up by the international energy agency and most recently by the OECD, apart from a whole host of individual countries. And all major economies began making plans for security of supply and what are called critical minerals availability strategies. Why minerals? Because of the specific path chosen for decarbonization you saw that brilliant map. But if as a layman I was asked to explain, I would say, is because minerals are used in devices for conversion of energy to electric power. The sun and wind have energy, but that is not usable. There minerals have specific electronic, optical and magnetic properties. They enhance electrical conductivity, light absorption, generational efficiencies and the durability of solar power equipment. Magnets enhance the efficiency of wind turbines. Minerals are necessary as catalysts for the electrolyzers which are going to produce your hydrogen. Electrical grids consume huge amounts of minerals like copper and looking to more industry more generally in our modern electronic and digital era, these industries are far more important than the smoke stacks of traditional industry. Therefore remember 60 minerals are used in high speed integrated circuits and electronic devices including the mobile phones which occasionally do ring. So, this is a one fact we have to keep in mind and India has committed to achieving net-zero emissions by 2070. I acknowledge what Dr Suman Bery has said. I think the Prime Minister was in fact slightly ahead of the bureaucratic establishment when he did that. And mind you, 2070 is nearer than you think, it is just 46 years away. Some of us in this room started our careers more than 46 years ago. And some of you will still be around in 2070. More relevant than 2070 I think are the targets which PM announced at

Glasgow which offer 2030 which is six and half years away and I certainly hope to be around in six and half years. Renewable energy is to be stepped up to 500 gigawatts from a 170 today. And domestically the plan for electric vehicles is to go for 30% to cars, 40% for buses and 70% of the total fleet of two wheelers. Where are we today? 2%. So, that is a long steep hill we are going to climb. In tandem the Indian private sector has announced very grandiose plans for hydrogen production. World scale plans. All this is going mean a massive increase in mineral requirements if we are to be Atma Nirbhar India. Particularly for critical minerals including rare earth elements and I am glad it was properly defined here as those 17 specific minerals. Now, identification, we have been told the two subjects of today, this has been made easy by the ministry of mines. And I am going to stick with their 30 mineral list. Because it was done with a lot of consultations and it has looked at all users of minerals. More important I think it explained why they are critical and we have heard this. Economic importance, high supply risk, substitutability and import reliance have to be looked at. Disruption potential etc. In terms of their uses, for energy transition, high tech industry and for India for food security. So, agriculture and fertilizers, thus in addition to the usual suspects, we hear lithium, cobalt etc. we have potash and phosphorous. I would add that in addition we need to look long term at minerals required for chemicals and pharmaceuticals because there is an increasing realization that the feedstock for these today is entirely petroleum. And once that ends things are going to have to change. I think a separate report for the defense ministry on their critical minerals is needed. Securing. First and foremost, Atma Nirbharta. That should be the target for securing these minerals. And the ministry of mine's report has a very valuable comment from NITI Aayog which points us in the right direction, it says India has the capacity to produce and scale up production in India of at least 10 of the identified minerals. Technical, administrative issues hampering production need to be taken up with the companies concerned. As I understand the issues are not administrative and technical, but they are rules, regulations and tax policies which lies in the domain of government. Ministry of mines has in fact acknowledged this by saying that scaling up production is being taken up through policy measures allowing private sector participation and exploration, incentives for exploration of deep seated and critical minerals etc. That is not adequate. Explorers must be incentivized, otherwise they will not come here. Contiguous mining should be efficiently licensed so that deep underground assets are efficiently extractable and not subjected to rules which apply above the ground. Today, less than 10% of India's obvious geological potential is actually exploited and I think we heard about this. The center and the states must work together to help us step up. The extraction of minor minerals as they are called, minor minerals, in refining and processing I think very correctly addressed. These are absolutely vital for renewable energy and what is very often forgotten is that they are very rarely viable for standalone mining. Three years ago, when I identified gallium and germanium among a host of others which require incentives for bauxite and zinc refiners to extract from their waste tailings, no one had heard about these. Unbelievably if you go and talk to industry you find that the government makes their life even harder if they try to extract these minerals from their wastes. In terms of their cost recovery and their taxes. For defense industry I think we need a critical mineral stockpile on the lines of strategic petroleum reserve which we have established. Second part of securing is the external supplies. KABIL as we have heard was set up some years ago, but so far at least the record is that it is not adequately equipped for the ruthless global competition for resources some of which are scarce and which require instant decision making. And some of these minerals are increasingly going to come under export controls as we have seen. Critical minerals are even more concentrated than oil. And a mineral cartel can make OPEC look like weak players. Understanding this requires looking at the supply chain at three levels. Geology and mineral extraction, beneficiation and

refining, processing and manufacturing of the end use product. At some point in these three processes, lithium, cobalt, rare earths, nickel, bismuth are dominated by three countries and China looms very large. My view as someone involved with foreign policy is exchanging dependence on OPEC for oil to China for critical minerals it is a recipe for disaster. Japan found out to its cost. I am happy to answer if anyone wants to know what that is. During PMs visit to the US visit last month we heard the Indian membership of the mineral security partnership was announced. And this I wrote about a year ago and I am glad it has become more commonly known. It is important to enable us to become part of global supply chains. And I think we can go beyond it and build specific critical mineral partnerships and joint ventures with some of these key friendly countries who know a thing or two about both mining and processing. I think it is also important to be part of R&D collaboration to look for alternatives or substitutes or what you call substitutability. Take the case of platinum. The OECD report which the G7 examined last year says that if we do all the hydrogen that we want to do, platinum production in the world has to go up by a factor of 150 by 2050. Does the earth have 150 times the platinum it is extracting today? No one knows. So, I think in my conclusion I would like to say, time has come not only for critical minerals but for a new perspective on mining in India. Mining is a messy costly business. That is why everyone in the world has been happy to leave it to China so far. But that is becoming dangerous. In the world outside both the climate deniers and the climate alarmists exaggerate their case on the impact whether environmental social or economic of the massive increase in mining which will be required to achieve net-zero emissions. That debate will go on. But capacity for mining and metallurgy will in future become part of the calculus of national power and strategic capability. Just as oil is now. As recognition of the importance of minerals grows, we must make use of the opportunity to make better use of our resources. We in India were pioneers of mining and metallurgy in ancient times. Even Kautilya talked about them in the Arthashashtra. We can greatly benefit I think not only critical minerals, but say producing gold, silver and diamonds. The reserve bank of India is buying gold from London. I think we can do well to produce a lot more in India. If you look at these three together and a few other precious metals, India can save over 100 billion dollars in foreign exchange every year. And build new industries for itself. Mining's contribution to GDP can be trebled from 2% which we get today closer to 7.5 to 12 which good mining jurisdictions get. Mining I think needs a paradigm shift in the popular perceptions to a more balanced picture. Net-zero imperative highlights the need for minerals and provides an opportune occasion to change the popular discourse. So far, mining has been treated almost like a quasi-criminal activity of people going and digging up the earth, spoiling tribal habitats, violating the sanctity of mother earth and so on. I think the work CSEP is doing is very timely in changing that paradigm. Thank you.

Rajesh Chadha:

I think we heard very illuminating views on mining in India. But I can guide you to yet another interesting discussion. Please visit our website. It is simple. Minerals at CSEP. We have a series called 'mining matters' dialogues where Ganesh is speaking with Mr. Mathai and that is a wonderful interview called 'Mining matters'. And it is just a click away when you go to minerals website. Now, thank you. Actually Mr. Mathai had said that he would need much more time. I requested and he agreed and thank you very much. So, next for discussion because there is a lot going on at the ministry of mines. Dr Dermal who is with us has been introduced already. But she has been on the various bilateral meetings on critical minerals strategy including bilateral talks with Germany, Australia, Russia, Zimbabwe, more recently she was the chairperson of the committee that has declared the 30 minerals as India's critical minerals and we had been interacting with you during the

writing of that report also. So, I think two questions if you can briefly address in next ten minutes. Like many other countries India has now declared the list of critical minerals. What has been the underlying methodology if you can tell us about that and second, what steps the ministry of mines has taken to secure resilient supply chains and the role of KABIL of which you have been going to the meetings. Thank you very much and please take ten minutes. Over to you.

Veena Kumari Dermal:

Six months back or almost a year back CSEP came to ministry of mines and they have given this presentation about the critical minerals which they have identified for the country. We were not kind of thinking about identifying the minerals which are critical for the country at that time. Subsequently we started kind of digging out our old files and trying to find out whether any work has been done on the critical minerals in India. And we found that some time back NITI Aayog has come up with a list. Then the geological survey of India has come up with another list. And then of course, KABIL has been given the target of identifying I mean securing on 12 minerals overseas India. So, that is the time when we thought its time, we need to come up with a list which is comprehensive, taking into account the requirement of different sectors. So, first what we did is we studied the list which were prepared by other countries like USA, UK, Korea, Australia, European union. We did a very simple thing. We just listed all the lists of all the countries. And we found out which are the common minerals which is coming in all their lists. So, we came out with 69 minerals which are common in all their lists which are published by the different countries. Then we circulated these 69 minerals to different ministries of the government of India. We circulated it to power, MNRE, agriculture, MEITI, pharmaceuticals, agriculture. Then we requested them… department of atomic energy also. We requested them, you please go through the list, you tell us whether this list include your mineral which is very critical for you, for which you are dependent on other countries or which is kind of… without which your major work cannot be taken up. We had a series of discussions with these ministries, we made them to understand. Because when we talk about minerals, say, they are not much concerned about the minerals which are going into making a chip or semiconductor or they are more into the production of semiconductor, they are not into the inputs for those. So, we had series of discussions with them. Then they came up… each of the ministry gave us the list which are important for their own sectors. And then what we did is, we then went back to CSEP, we went to IEA, international energy agency, we had discussions with CEEW, so we involved the think tanks in this. We tried to understand how they have come up with their list of minerals. What we found is that CSEP is using the EU technology and we tried to use the same technology or same methodology for assessing the criticality index. But then we had some difficulty because the reliability of the data was a little concern for us. So, instead of going for the substitutability index and cross cutting index and especially the GVA multiplier factor we had some difficulty because we wanted to be sure that whatever data we use is perfect and it is not questionable at any point of time. We then came back and worked out our resource availability within the country and for all the minerals which are identified and the import dependency for these minerals and also economic importance of this mineral and based on these economic importance and supply risk, based on the import dependency and the availability of these minerals within the country we finalized and came back with this list of 30 minerals. But our list is like we have not taken out… the REE we took as a single mineral, but as you know there are 17 minerals in that. We think that we have taken into account the current requirement of different sectors as well as the current resource reserve availability and the import dependency while finalizing these minerals. But we also know that this is not a static kind of list. This

is dynamic. This has to be revisited with the change in technology. So, while submitting the report we have recommended to the government that this list needs to be revisited at a periodic interval as decided by the government. So, we hope that… because only a week before we were publishing our list, Australia came up with a revised list. So, it is dynamic. But we think that for the time being we have done our due diligence taking into the requirement of different ministries. Thank you.

Rajesh Chadha:

Thank you very much. And it was a pleasure meeting and discussing with you and the secretary and the other officers, the work that we had started three years ago actually… our first brief paper was published three years ago in 2020 on skewed critical minerals and what risks India is likely to go through. Thank you very much for coming and presenting that. It was wonderful attending the event at India international center where the report was released. I think then once we had Mr. Mathai and we had the government representation, it is my pleasure that we have the private sector views now with us. I welcome Mr. Pankaj Satija who has been introduced. He is the cochair on the FICCI mining committee. And other introduction has been given but I think one of the things that I wanted to speak about Mr. Satija is that he spoke on securing critical mineral supply chains for India's transition towards 2030 in a FICCI conference where he quoted us and presented our earlier study. Not the recent study. And he has also been talking about the new age energy minerals. Mr. Satija mentions that the new age and critical minerals must no longer be treated like bulk minerals. And the industry must find ways to increase the scale of minerals supply while maintaining profitability. So, two questions that we raised for his discussion in 10 minutes. What challenges does the private sector face in exploration and mining of critical minerals, A? B, what role should the private sector play in integrating with global critical mineral value chains because once you have lithium then what? What do I do with it unless we are connected with the value chains processing, beneficiating etc.? And how do environmental and social externalities affect the decision to process these minerals domestically versus overseas? Over to you Mr. Satija. Thank you for being with us.

Pankaj Satija:

Thank you very much. So, before I take you to the future challenges let me take you to the history also. So, this story belongs to a person who was born in1855 in Bengal. Studied in St. Xavier's college. 74, he got one Gilchrist scholarship which helped him to go to Royal school of mines in London. He completed his graduation, came back to India in 1880 and he joined GSI. In GSI he discovered one of the well known deposit of Dalli – Rajhara, which became the basis of Bhilai steel plant. He was given the responsibility of finding the coal mines in Darjeeling, which he could do successfully. After separating from GSI 1903 he found one of the best deposits which encouraged Tata steel to put up a steel plant in Jamshedpur. And Orissa got its first mine. And today Orissa produces more than 50% of Indian iron ore production. The credit goes to him. Dr P N Bose. Now there are many things which I have not told in this storytelling. He didn't have a vehicle to go. Roads were not motorable. He didn't have the GPS to find out the location. He didn't have the medical facilities to stay in the remote areas and he stayed in the camp with human, animal conflict. But he did so many things which paved the path of industrial revolution in India. In today's OTT language 'Bas ek bandaa hi kafi hai'. So, that was his background. And then many other geoscientists collaborated, they came, new discoveries were made and India saw its industrial revolution. So, when we are talking about industry 4.0, we talked about so many minerals, but we forget that industry 1.0 when steel was there, we needed coal. Only thing, the number from one it has gone to 40. But minerals were always the backbone of industrial

revolution. So, things went very smoothly till 1990s. And late 90s we saw many flyby night operators coming into the mining area which was very lucrative for making more and more money. And then many commissions were constituted. Mr. Mathai was saying and Shah commission came and lok ayukta report came in Karnataka. And miners who were supposed to be in the mines, they were found in the court. And 2015 the new act came. And what it has done in a thorough way 3.5.6 it is written __ (Sanskrit saying not captured). The metal and the mining industry people they are treated as manishees. The learned and the wise person. And Dr P N Bose was also invited by Raja of Mayurbhanj in 1903 but by 2015 the miners and metal were seen in the court with all the bad names. So, that is the transition, I can say that we reached the _ at that point of time. That damage what it has done, that mining is no longer seen as an industry which has little prestige, so it has lost its attractiveness to attract the talent. That is one thing which it has done. Secondly, it has created mistrust also because between the different constituents and that is why the policies were made that it should have more and more transparencies and auctions was introduced, explorations were given by the NMET. And the private sector participation which were there in the earlier time lost its charm because the minerals were not to be given on first come first serve or on your application but it was on auction. So, most of the mining companies they have a typical setup of greenfield geologists stopped. Because there is no point in exploring and applying for lease because the leases were not supposed on your application but on the auction. So, it was like a standstill. And you have to borrow verses from Dr Bhashir Badr – mein apne hi rah mein deewar banke baita hoon. Wo ayega bhi tho kis raste se ayega. So, this was the scenario in 2015-16. Government took lot of actions and NMET came and 4266 crores have been deposited as on 30th November 2022. 750 crores or 520 crores has been spent also. But the private sector participation is not there in exploration. So, if you compare with Canada, it is 33 thousand crores. If you compare with Australia, it is 19 thousand crores. So, off late there has been a structural change in the mining which has to be seen internally and from the external perspective also. So, if you ask me what should be done, the private sector participation risk reward ratio has to come, how it has to come again… government has also brought a stakeholder consultation in February this year only. That the junior miners can go for the reading and the reverse bidding and once it is auctioned, they will get certain share. I am sure that the final footprint or the final blueprint will have much more encouragement and excitement for the private players to participate and mining industry will also have its own charm which used to be earlier, government has instituted sustainable development framework star rating of mines have come and slowly the miner will do better things. And it will attract new talents to be in the mining and the processing industry. So, my two immediate if you ask me, these are the things which I wanted to ask. From the exploration point of view. From environmental point of view, when we talk about critical minerals, so it has been spoken by the previous speakers also, it has to be three prong approach. One is byproduct because we have lot of tailings and we know that records. Few years back we have a track record, bad track record of one fly ash failure in every two months. And we have seen dam failure in Brazil and others. So, how we can go towards zero waste policy because this was also initiated in national mineral policy also. So, first approach should be on the byproducts from the tailings because we have also… gold was being talked about, so lot of gold tailings are there in Kolar, how we can recover from there. And there are many other tailing dams which are good potential for byproducts. So, that is one. Direct excavation and mining will come only when you have approved resource. So, whenever people talk about mining, I personally feel that mining is very similar to pharmaceutical companies. You take thousand trials to come out with one vaccine. So, in mining also you go to 1000 prospects. Out of thousand you come to 100 which had certain potential. Out of 100 you come to 10 which can

be mined and one becomes the successful commercial mining. So, the money part should not be seen from the first which is successful. It should also take into account of the thousand unsuccessful attempts also. So, unless that reward is there commensurate to the risk, the investment will not come. Environmental point of view, I would say that it should not be seen from the legal perspective. It is more ethical and more moral. So, in Atharva ved Bhoomi sukta, it is very clearly mentioned, Maata Bhoomi putrohum Prithvya. (माता भूमि पुत्रोहं पृथिव्या) And it also mentions how you should dig the earth. It says that (Sanskrit shloka recited) "Oh mother earth, whenever I break or dig something it should recover or really replenish as early as possible and I should not touch the vitality of your core". So, that is the ethos which were there in Indian system. Legally you can say that if you violate, you will be penalized. So, then people will find the ways how to deviate from those rules and that is why miners were in bad time. Critical minerals will have a different ball game, different perspective in terms of mining and in terms of beneficiation or the processing. It is not simple cleaning and washing over by water which has been done in the bulk minerals. You will have hydrometallurgical process, you will have pyrometallurgical process, you will be using a lot of acids, solvent extraction method and lot of waste you will generate in terms of waste water, in terms of gases and that strategy has to be made. The ESG framework for this particular aspect has to be created before we go for that. The third aspect is on recycling 'urban mining' which we call. But then also require a different skill set because if you are recycling electrical appliances or electronic appliance of 1990 and then 2000 or 2010, the constituents of these three products from the same country will be different. So, the person who is going to use that for his recycling you should understand that what chemical or mineral constituents are there in these three products of the same company. So, the different methodology can be used. In my opinion India can't wait for one strategy. It has to follow the three strategies together and environmental aspects has to be taken care about. As such we face in the bulk minerals also. Because incidentally if you see the map of minerals in India and if you super impose with the forest or with the area which is low in SDI or the area with watershed or with low SDI all overlap. And then we have COP15 where it says that by 2030, we will have 30% of the area protected. So, as such for the bulk minerals we have a very stress target for meeting those environmental norms. With critical minerals we need to tighten our belt much faster. Thank you very much.

Rajesh Chadha:

Thank you very much, Mr. Satija. I thought we were running late. We are running around eight minutes or nine minutes late. Open up for the discussions. Please point your questions to the specific panelist. And questions rather than comments.

Audience 1

Exploration. Certain areas which have not been exploited, China is definitely gone many places. In Myanmar on our border there needs to be some exploration by India. Similarly in the desert sands in Middle East nobody has gone there. There may be something. Private companies can do what Adani has done in Australia. Everybody was criticizing him. Prime Minister, Australians, all backed him. So, there are areas where the private sector can go into, what Adani has done. We have to go to search of what thorium derivatives can be got out of thorium sand we have got. All the major oil companies in world are investing in new explorations. It is ONGC and the oil guys are all doing the same. If not, they should do so. Deep sea exploration is a new area. Much more should be spent by the government of India in something which nobody has yet gone into. Because all my ____ (inaudible), in the areas that are given. That's it. Those four points. Thank you.

Rajesh Chadha:

Thank you very much and very important observations and we are also working on deep sea mining. Probably there is a paper lying outside. We have just begun the journey. Here, please identify your name because this is being recorded.

Saibal Ghosh (Audience):

My name is Saibal Ghosh and I am the trade commissioner from the high commission of Canada. Looking after the mining sector. My question to you Ma'am is that, we have seen KABIL and before that we also had seen ICVL at one point of time and if we now know like where ICVL went. So, in terms of KABIL, in terms of making it more effective and in terms of sort of pushing it ahead, are there any specific steps being taken as such to energize this KABIL per se in this current competitive world.

Rajesh Chadha:

We will take three questions. Identify yourself. And then you.

Ramananda Sengupta (Audience):

My name is Ramananda Sengupta. I am with start news global. This is for Mr. Mathai. We have a security partnership that was formed last year. We were not initially part of that team because I believe it did not bring sufficient expertise to the table. This year we joined. What has changed in the one year?

Neha Mishra (Audience):

Hi. My name is Neha Mishra. I am an associate fellow from center for Air power studies. My question is for Ma'am and Mr. Mathai. Recently center has allowed around 12 private agencies to explore or do mining with some rules attached. So, just wanted to know because in the past it was banned, the private companies were banned because of some illegal mining and exports. So, I just wanted to know your thoughts that, was it the absence of rules, proper rules to make some accreditation of these private agencies or was it just the mining issue or the exploring issue by these private enterprises? Was it the absence of attention by a government or was it just the corruption by private enterprises? What is your thought on it?

Rajesh Chadha:

If we can quickly answer these.

Veena Kumari Dermal:

First about KABIL. Yes, KABIL, I do not know, what I can say is we are having discussions with some countries for acquiring assets. Basically, KABIL has 12 minerals. Now we are concentrating on lithium and cobalt. And there is lot of talk about KABIL not having enough support. But it is not really correct. Because KABIL need not be the company who will be acquiring the assets in other countries. Because KABIL is the front portion which will go and have discussions, find out the kind of assets available. All the other government companies and many other government companies are also kind of shown their interest in investment. Once the KABIL do the due diligence for the blocks, other companies like whether it is coal India or NTPC or some other government companies having enough financial

strength will come up and invest. So, we are very confident that in a short time KABIL will come up with a few blocks acquisition in some countries. And Australia also we are hopeful that in some time. Because what we are currently doing is, we have identified a few blocks in one or two countries. And what we are doing is the due diligence for these companies. Because we need to be sure about the company strength and the block's potential before we invest. So, KABIL is fully prepared to invest and we have all the government of India companies, most of the mining companies, PSUs in mining sector from the government side supporting KABIL. This is not a problem. The delay or the time which we are taking is mainly for assessing the potential of the blocks. Coming to the question of Madam, basically like, it is you cannot say it is illegality of the private companies which has prevented private companies from coming into exploration. As Mr. Satija has told before 2015 our legal framework was such that any person who apply and get an area means, it is based on application. You get an area, you do exploration, you go to mining. Whatever be the reason 2015 we have introduced auction as the methodology for allocating the mineral concession and this is one of the few countries which has auction methodology. And at that time our law has allowed only the government notified agencies to do the exploration. There is particular section in the act which says and they have to get notified and at that time the provision was notification of only government agencies. In 2021 we brought in an amendment in which we told and it has made provision for notifying the private exploration agencies also for doing the exploration. After 2021, then we put in place some system of accreditation of private exploration agencies. Now we have notified 14 agencies and these agencies are getting funding from the national mineral exploration trust for taking up the exploration work. Its not anybody's illegality which has created that situation. It was the existing legal framework which we have changed.

Rajesh Chadha:

Thank you. We do have a discussion note on NMET, how NMET has been operating and how little participation from private sector has come into… so we have a full discussion note on that. Mr. Mathai, any of your opinions.

Ranjan Mathai:

In general, I think she has answered the question. But the experience around the world is that usually exploration and production go together. That is one of the reasons why we don't… haven't been able to attract some of these junior explorers also because they are not able to convert what their hard work does into effective actions. In fact, this lack of knowledge about this extends not only to people like us but deep inside the government. In 2015 I was personally present when one of the senior most members of this government, he will remain nameless, was sitting in London and the head or chairman of the Rio Tinto was sitting across the table and asked him about… he asked him why he was thinking of leaving India. And explaining this problem. He said, do you mean to say when you find a mineral you can't exploit it? The chairman said yes sir. Both of us nodded and took notes. That is all we did. But I will like to mention something on the mineral security partnership you asked. The reasoning there could be multiple. But when mineral security partnership was created, I wrote about it in July 2022, a few weeks after it was launched. It emerged from a certain strategy particularly of the OECD countries. The United States, Europe, Japan, Korea and few others. Australia and others. In fact, the way it emerged and the way it was announced during a mining conference really low key and so on, but people understood what it was. One analyst in fact, called it a metallic NATO. So, that was the kind of backdrop and the Chinese got the message immediately. There were two stinging attacks

on it in the global times within a few weeks. So, that I think is the background. But there is a realization that when you are talking about geological assets leave alone processing in mines, you have to get out of these charm circle of these 14 countries. And the global south is where much of the action is going to be. The mineral security partnership held a conversation in February this year with four or five African countries and by now many of those countries know how to deal with the external investors trying to come and sell them a line of goods. I have a feeling getting India in, first of all we bring a certain geological capacity, a certain scientific ability and plus we have credibility with the global south. That is my hunch. But that is only a hunch. I don't have exact reasoning for it. But it can make it a far more balanced organization and one to which perhaps will not look confrontational when you are talking to Chinese. Deep sea mining, sir, we have looked at it. We were among the very early pioneers of deep ocean exploration going back to the times of Mrs. Indira Gandhi, that time. And I think we have done a lot of work, we have identified zones, we have I think even applied for licenses. But there are two factors. One, there is an extremely high cost involved. And you need a concentration of minerals which would make that very high cost immediately viable. And second, today there are very serious environmental objections to going and churning up the bottom of the ocean.

Rajesh Chadha:

Thank you very much. There is a question, so that we are not partial from zoom. Partly we have already answered. What policies currently exist for critical mineral security and how well are they being implemented? I think in the discussion that we have had we have already discussed the mineral security partnership and Mr. Mathai has clearly pointed out that incidentally India is the only developing country in that G7 club that was constituted last year as MSP. So, we should be happy about it that we have moved a step forward. This is only to take two more questions. Please identify yourself. Just a brief question and I think most of the answers have been given.

Prof. Shastri (Audience):

I am professor Shastri. I teach in a management school. So, my question is to Madam. The criticality of mine and minerals is understood. Because we don't have a resource base. But in the government communicated the question of the major minerals like say for example I know, on and off policies by the government, we need to lose the precious contracts foreign exchange. See the point is the criticality every year planning commission will do meetings and all that. So, this is very, very low based iron ore or magnesium ore or coal ore. But things are going to continue. It is very difficult to convert a contract from Japan or China and other things. There is a dog eat dog age. __. You will not get the contract. So, all the point in case, at least major minerals one establishing criticalities one has to take into aspect all these aspects including the foreign exchange earnings, export and other things. Otherwise, many a times we lose contracts to Australian companies. Because they say this is high grade or something. My question is criticality of the measurements and the criticality of the minor minerals, one has to take into account export earnings also in this case.

Rajesh Chadha:

Thank you. Yes. One more here.

Abhishek Sharma (Audience):

Hello, I am Abhishek Sharma I am an associate fellow at an institution. My question is to Pankaj Satija. Particularly if you compare the strategies of developed countries like America and south Korea and Australia, even to China, what comes very common is the close working relationship between private sector and government. So, my question is, is there any attempt on the private sector in India to kind of formulate a strategy on their own and kind of put them in front of the government so that there is an understanding in the government that what the private sector meant. Because going forward as India wants to develop capacities in certain sectors its very important to have this question.

Rajesh Chadha:

Role of private sector. So, two more questions and that is the end.

Anjana Das (Audience):

My name is Anjana Das. I am from IRADe. My question is government of India wants to develop its electrolyser manufacturing capacity. And recently it has invited bid for also 1500 megawatt. My feeling is it will be mostly PM type of electrolyzer. But because of its compatibility with variable generation resources but that needs platinum. So, question is how government is dealing with platinum requirement?

Surendra Singh (Audience):

I assure you Dr Chadha. Only one question. It has been answered partially. But I was just going to ask… my name is Surendra Singh. I work as carbon analyst. If Mr Satija could answer this. I am going to look forward to this sea bed paper. Anyway, there have been near US Hawaii, there is this specific zone I forget the name of it, where we are exploring seabed for these critical mineral needs. Is this only the money or the technology which is stopping us from doing the seabed exploration or do you think there is some other reason why? We know that these identification security needs to happen, but we still have not been able to do it. Thank you.

Rajesh Chadha:

Madam, you had a question. I don't want to miss you.

Audience:

We have talked about exploration which of course is very important. But what about a value addition of minerals, how much of an effort is being made by the ministry as well as the industry. Because ultimately if we talk of critical mineral security and making our end use industries like energy resilient, unless we have the processing capability just you know securing minerals either from abroad or extracting more is not going to really help in those industries.

Rathore shah (Audience):

Good evening, I am Rathore Shah. I work as senior manager critical minerals for GMDC. Similar to the question asked just now, when we talk about minerals like rare earth metals and stuff, we talk about the entire value chain. There are some proprietary technologies involved post the refining and end-use permanent magnet manufacturing and stuff. Is there anything we are doing in India to promote research in those sectors? Because we have, I believe enough capability in mining, processing, separation, solvent extraction like sir mentioned. But, post the refining part I think the capability is concentrated with only some countries. And only some private players outside…

ex-China, some small private players. So, is there any work being done on that front is what I would like to ask.

Rajesh Chadha:

Thank you very much. I think I can sum up the questions that have been asked in a couple of sentences. The questions have been – is government doing enough to look beyond finding the criticality of the minerals. Second is what role the private sector should be playing and that is important to look at NMET which we have done. The third one obviously is I think all the questions are wanting to know, are we integrating with the supply chain. And integrating with the supply chains is an important research area that CSEP is now looking at and any final remarks from the panellists very briefly.

Pankaj Satija:

Many questions were there. So, we must remember that India is a federal structure. While the policies are made at centre but then there are different KPIs and different results at different states. I operate from Orissa. I can very well say that the industrial environment and support from Orissa government is one of the best in the country. And that is the region which is seen that more than 50% production of iron ore happens in one state. Orissa if I say that it is the mineral capital of India it is not an exaggeration. However, there are many complexities involved with mining. As I mentioned that many areas overlap with forest area, areas with low SDI, with low left-wing hectorism, area with watershed. And incidentally we have different government ministries for different areas. If I am going to do the mining, I will get permission from state mines, as well as from state government, but then I have to have forest clearance from MUF, I have the forest rights act involving gram-sabha from the local government authorities and there are different set of regulations which have its own implication step by step different.

Veena Kumar Dermal:

Almost answered. It is like NMET efforts, mining has starting from mining law making, allocation to state governments and then beneficiation study done by labs and then further value addition by the concerned industry sectors, it is the whole supply chain, many ministries many departments of government come into picture. I am sure everybody is doing their own role and responsibility and also, we always consulting each other. Whether we make a law, we always put it in our website and state government and all the stakeholders we are continuously informing. We get their inputs. And similarly, when others are introducing new programs, we are consulted always. It is a collective effort.

Ranjan Mathai:

Just on the processing and absolutely right. Value addition is really the name of the game beyond mining. We have to get used to the fact that it is not going to be very popular. There are very powerful lobbies which are going to be working against it. The world experience, you can go from one extreme _ in China, where the process of extracting one kilo of rare earths takes a thousand kilos tonnes of rock. And it is a real mess. And on the other in Hamburg, we have a copper smelter right in the heart of the city and it functions. But in India we have the NIMBY problem. Not in my backyard. We want all the minerals possible. But not in my backyard. We have to find a via media.

Rajesh Chadha:

Thank you very much. And it remains for me to say that this turned out to be an interesting session, education for us and the team and that people are still with us even though we are 15 minutes above time. But I will not close before saying my thanks to Dr Laveesh Bhandari particularly for staying through the session and I have requested him to say a few words. He has taken over as the president of CSEP a couple of months ago. He is my colleague from national council of applied economic research. He leads the climate change and sustainability research at CSEP and has published widely on sustainable livelihoods, industrial economic and social reforms in India. He has taught economics at Boston university and IIT Delhi and has been the managing editor of the journal of emerging finance market finance and worked with us at NCAER while Dr Mohan was also there. So, over to you Laveesh for any final thoughts.

Laveesh Bhandari:

Thank you very much. What is happening here is that two amazingly passionate and energetic researchers under the watchful eye of Dr Chadha's experience and with all the support and vision that all of you giving to us is really creating magic. This whole space, there is lot of action that is happening. Some unfortunately believe the critical minerals are a defensive reaction to an emerging problem. Actually, critical minerals are an opportunity. Unlike any that we are facing right now. It is not just about India. Critical minerals are giving us global opportunities. And that is how we see it. So, essentially all the inputs that have come in which is about exploration, about international relations, about setting up the processing facilities, about the time path of when these investments and actions will be required, are all subjects of great interest to us. So, I would just request all of you that in case you have any thoughts, any ideas, please do continue to interact and engage with us. So, thank you very much and good luck to everyone. Thank you everyone for being here.